IMPORTANT: this manual must be kept near the heat exchanger.

CIPRIANI
SCAMBIATORI

USER AND MAINTENANCE MANUAL

USER AND MAINTENANCE MANUAL

Foreword page 2

1. Use

1.1 Installation page 3

1.2 Start-up page 4

1.3 Short term interruptions page 5

1.4 Long term interruptions page 5

1.5 Dismantling procedures page 5

1.6 Assembly page 6

1.7 Assembly diagrams page 7

2. Maintenance

2.1 Manual cleaning page 9

2.2 Check with penetrating fluids page 10

2.3 CIP (Cleaning in place) page 10

2.4 Plug-in gasket replacement page 11

2.5 Glued gasket replacement page 12

2.6 Warnings page 13

3. Risk analysis page 14

4. Troubleshooting page 19

5. Component blow-up drawings

5.1 models 020+ 040+ 080+ page 21

5.2 models 100 125+ 250 page 22

5.3 models 300+ 450+ page 23

5.4 models 650+ page 24

Foreword

This **User and Maintenance Manual** is intended as a tool for personnel involved in installation, running and maintenance with view to avoiding any malfunctions and/or maintenance errors as well as uses not envisaged at the design stage of each individual marketed product.
Correct, complete and careful maintenance is fundamental to long-lasting product performance.

Exceeding design limits even temporarily (e.g. when starting or stopping) should be absolutely avoided since the heat exchanger could be damaged.
On this matter Cipriani Scambiatori s.r.l. assumes no responsibility whatsoever if the customer does not observe the running conditions as per the design discussed at purchase order phase. In fact these specifications allow to classify the heat exchanger in precise risk categories (cat. I-II-III-IV) and consequent application modules (mod. A-A1-B+C1-B+F) with view to satisfying all the safety requirements of P.E.D standards.

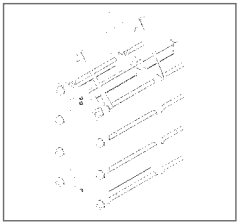
The safety conditions are shown on the label fixed to the heat exchanger frame and glued to the back cover of this manual, with all additional data as prescribed by the Pressure Equipment Directive (Legislative Decree N° 93 of 25.02.2000).
Any modifications of the plant and consequent functioning of the heat exchanger in conditions other than those for which it was designed must be promptly communicated to Cipriani Scambiatori s.r.l.
The Technical Department will provide for examination an approval of the different operational conditions and if necessary will be available for evaluation of a new and convenient solution.

Observance of all the regulations in force concerning production and marketing of pressure equipment has brought Cipriani Scambiatori s.r.l. to the achievement of one of the highest manufacturing standards in the sector, guaranteeing the user against all unjustified malfunctions.

Cipriani Scambiatori Srl cannot be held responsible for any damage to persons or property resulting from failure to observe the operating instructions described herein.

1.1 INSTALLATION

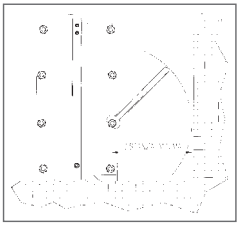
Unpacking
All Cipriani heat exchangers are packed on wooden pallets and covered with shrink-film to protect the heat exchanger. Spareparts may also be packed on pallets or in packages. Check the delivery note to ensure that all the parts are included and that there is no nonconformity. If anything is missing or non-conforming, you must notify our headquarters in writing within 10 days of receiving the goods.



A

Handling
The heat exchanger is very heavy. You are advised to handle it with slings fixed to the frame. The slings must not be chains or metal cables (see drawing A).

Never handle the heat exchanger by the connections because they could get damaged.

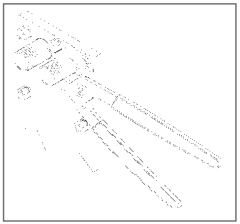


B

Placing
The heat exchanger must always be installed in a vertical position, especially in case of multipasses, in order to ensure its stability. It must be suitably fixed in such a way as to leave sufficient space to facilitate inspections, maintenance and repairs (see drawing B).

Be sure to keep the following heat exchanger documents in a safe place:

- user and maintenance manual
- CE Statement of Conformity / Product Conformity (PHE exempt as per Art. 3.3 Legislative Decree 93 of 25/02/2000)
- specific thermal programme that sets the values of the variables in working conditions as per the design.



C

Connecting
To connect the tubing to the heat exchanger, follow the instructions on the label showing the circulation diagram.
In the case of mobile connections, you are advised to lock the outlet with parrot-nosed pliers in order to avoid damaging the initial gasket (see drawing C).
Before connecting the heat exchanger to the plant, check for correct tightness of the plate pack as shown on the label. If necessary adjust it following the instructions on page 6.
In the case of mobile large plate connection (multipasses) there must be working space for longitudinal movement of the plate pack for the replacement of worn gaskets or for adding plates. There are special compensators for avoiding additional stresses on heat exchanger components.
Absolutely avoid tubing weighing on the outlets: there could be leaks if the latter are subject to loads, movements or vibrations.
In case of connections to be flanged, the gaskets must be tighted 2 mm, in order to avoid damages of the gaskets.
As for the range DN 100 and DN 200, the flanged connection to the plant must warrant the rubber liners seal between the head frame and the flat flange, respecting a minimun opening of 2mm.

Never position permanent tubing in the space between the rear frame plate and the rear support because this would impede opening of the heat exchanger. In the case of multipasses, provide for removable bends on the tubing connected to the rear frame plate.

the following fixtures must be foreseen:

- inlet and drain valves permitting opening of the heat exchanger without interfering with the other elements of the plant and avoiding fluid residues in the heat exchanger when it is not running. This is particularly recommended in the case of corrosive fluids;
- vent valves on the inlet tubes, installed at the highest point in order to bleed air from the heat exchanger internal circuits at first start-up.

Check that there are no impurities in the tubing such as sand, welding residues or other solid detritus that could damage the plates and gaskets. If there are solid particles in the tubing, filters should be used to avoid jeopardising the heat exchanger's efficiency.

1.2 START-UP

On starting up the heat exchanger, observe the following procedures:

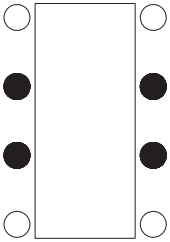
- check correct tightness of the plate pack as shown on the label;
- with appropriate checking instruments make sure that the tubing is guaranteed against sudden overpressures and thermal jumps;
- check that pressures and temperatures are in line with the values agreed on at design stage;
- once the tubes are connected, slowly fill the circuits simultaneously;
- when both circuits are filled, slowly open the valves and put the plant under pressure;

Warning: to avoid any "water hammering", open the valves gradually; sudden accelerations of fluid could cause increases in pressure many times greater than the working pressure.

Warning: damage to the frame, but above all to the heat exchanger plate pack, may occur if the latter is subject to continual vibrations or frequent stops. In any case, when the heat exchanger is running you must not change the functioning parameters or exceed the envisaged working conditions.

1.3 SHORT TERM INTERRUPTIONS

- gradually reduce the pressure in both circuits.
- stop the pumps and close the delivery valves.
- empty the heat exchanger completely.
- close the outlet valves.
- do not open the heat exchanger when it is still hot. Leave it to cool until it reaches surrounding temperature in order to avoid damage to persons or to the gaskets.



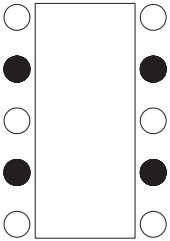
1.4 LONG TERM INTERRUPTIONS

The same conditions as "short term interruptions" are valid, with the following recommendations:

- store the heat exchanger in a closed space (temp. 15-25 °C and max. humidity 75%);
- provide for washing the heat exchanger circuits with water to eliminate all residues;
- loosen the nuts of the tightening bars to reduce pressure on the gaskets;
- apply an antirust product to the tightening bars;
- cover with a tarpaulin, especially if it has to be stored outside;
- when it is to be used again, carry out routine maintenance to reset the components and improve smooth running in their couplings; dampen the tightening and guiding bars and with liquid lubricant.

1.5 DISMANTLING PROCEDURES

The Cipriani heat exchanger has a guarantee seal on the plate pack. If you have to clean or carry out other interventions on the heat exchanger during the guarantee period you must ask for written authorisation from our headquarters. Otherwise the guarantee is rendered null and void.



Disconnect any tubing connected to the rear frame plate.
Lubricate the tightening bars and loosen all the nuts except those marked with the "filled-in circle" in the drawing at the side. These should be removed last of all.

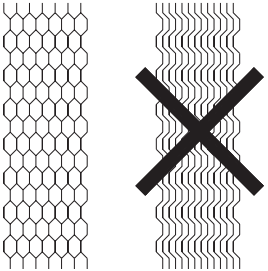
Move the rear frame plate back and remove the plates one by one. Take special care in order not to damage them or cause harm to the operator. Warning: the plates are sharp, so wear protective gloves.
The plates should be laid on a flat, clean surface, avoiding any contact with ferrous particles or dirt.

Note:
After an heat exchanger has been working at high temperatures for a certain period, the gaskets tend to adhere to the next plate. This is noted only when the heat exchanger is opened. In such cases the plates stuck together must be separated with great care, especially, with plug-in gaskets in correspondence to the attachments, so that no damage occurs. Such care, especially with plug-in gaskets if they still retain their characteristics of resistance, usually makes it possible to close the heat exchanger and reuse them, avoiding replacement.
It is therefore good practice to limit the number of times that the heat exchanger is opened.

1.6 ASSEMBLY

Before reassembling the heat exchanger, check that all the plates and gaskets are clean and without particles of dirt which, adhering to the gaskets, could cause fluid leaks when the heat exchanger is brought back into service.
Insert the plates in the heat exchanger following the diagram on page 7 or 8, depending on the type of pass.
Take care that the plates are perfectly aligned in the unit, giving the profile a beehive form.
In the case of multipasses you are advised to number the plates at time of opening the heat exchanger in order to ensure correct positioning during the assembly phase.
The tightening gauge (distance between large fixed and mobile plate, in mm) appears on the heat exchanger label and may in any case be taken from the following table:

If the plates have been correctly assembled,
the plate pack,
seen from the side,
resembles a beehive:

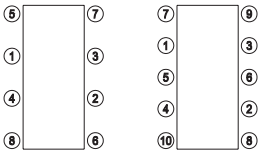


S 020+	S 040+	S 080+	S 100	S 125+	S 250	S 300+	S 450+	S 650+
np x 3 mm	np x 3 mm	np x 3 mm	np x 3.1 mm	np x 3.4 mm	np x 3.5 mm	np x 3,2 mm	np x 3,2 mm	np x 3.4 mm
+2 mm	+2 mm	+2 mm	+2 mm	+2 mm				

np = number of plates
NB: The heat exchanger should be closed at tightening gauge, without being under pressure.
NB: In the case of flanged or welded joints, reduce the tightening gauge by 2 mm (only for models S020+, S040+, S080+, S100, S125+).

Warning: if there are fluid leaks and it is therefore necessary to intervene to modify tightening of the plate pack, contact our technical department at once for evaluation of the specific situation: the plate pack may be permanently deformed as a result of incorrect tightening.

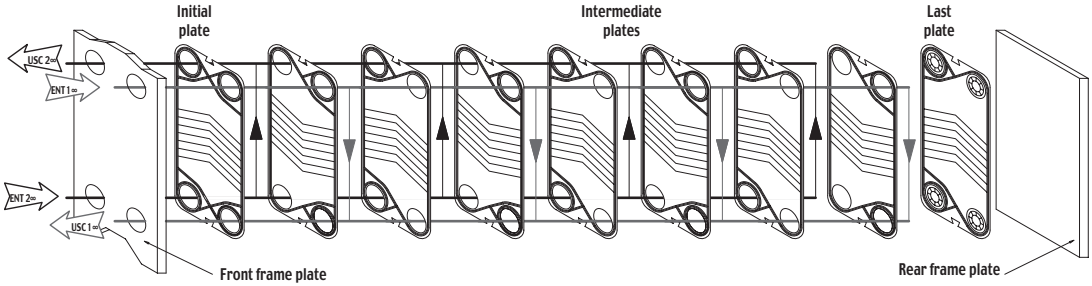
The following diagram shows the tightening sequence:



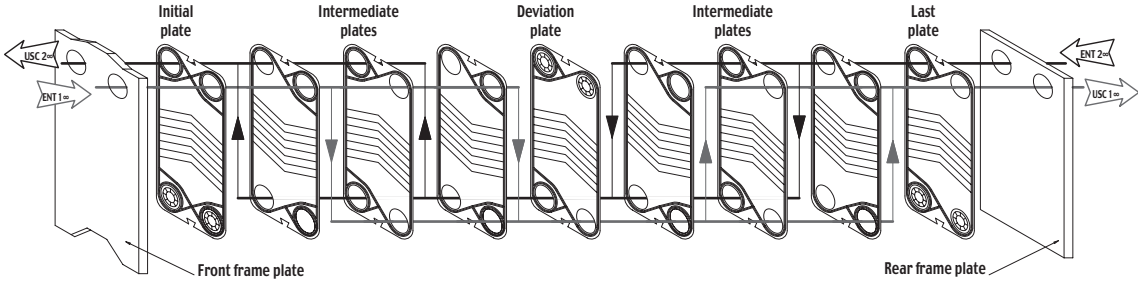
The tightening sequence is highlighted in the following diagram:
Necessary keys:

Model	S 020+	S 040+	S 080+	S 100	S 125+	S 250	S 300+	S 450+	S 650+
Tightening bar nut	M14	M14	M14	M16	M20	M24	M24/M33	M24/M33	M33/M39
Key	22	22	22	24	30	36	36/50	36/50	50/60
Upper guiding bar nut.	M12	M12	M12	M16	M22	M22	M14	M14	M20
Key	19	19	19	24	32	32	22	22	30
Lower guiding bar nut.	M12	M12	M12	M16	M22	M22	M18	M18	M20
Key	19	19	19	24	32	32	27	27	30

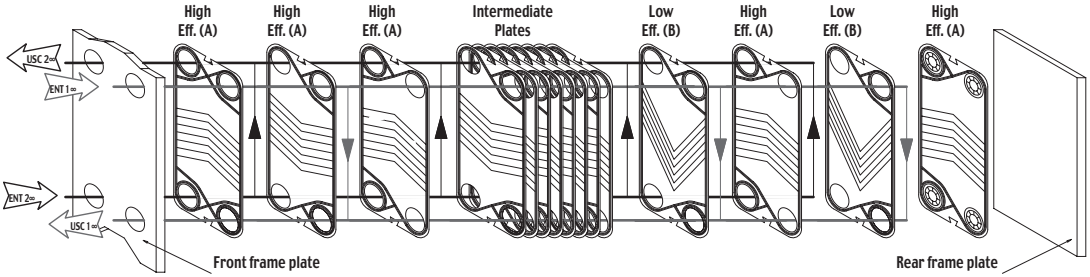
Single-pass 1-1



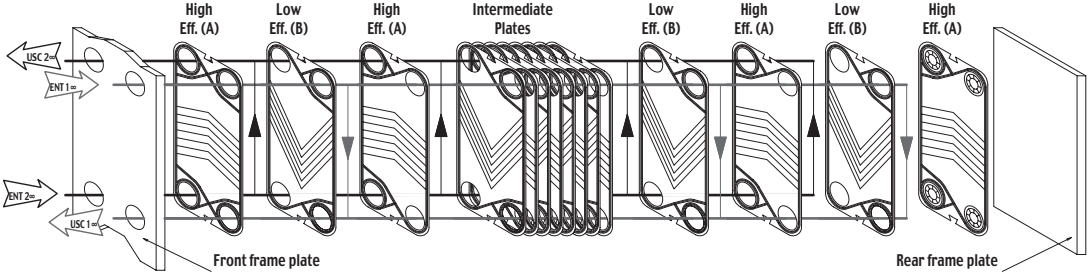
Multi-passes 2-2



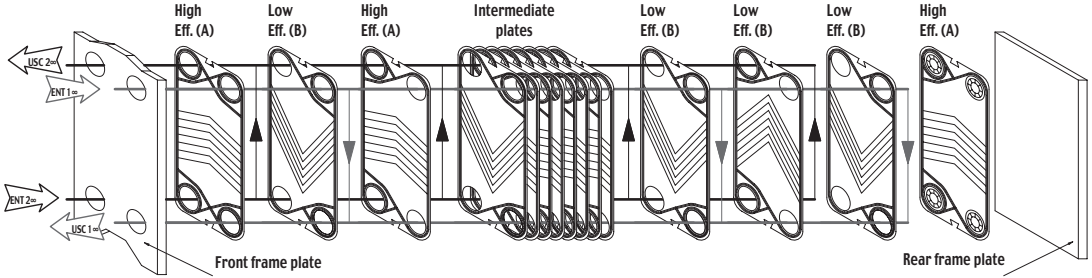
Mixed thermal length M, plates in high efficiency (A) > 50%



Mixed thermal length, plates in high efficiency (A) = 50%



Mixed thermal length, plates in high efficiency (A) < 50%



2. Maintenance

Maintenance is fundamental to guarantee the correct functioning of the heat exchanger over the years. Any solid residues (scaling and deposits) can jeopardise gasket seal, corrode the plates and also significantly alter performance in terms of heat exchange. You must therefore follow the manufacturer's instructions carefully.
Cleaning of plate-type heat exchangers can be done either manually or with CIP (Cleaning In Place) operations.

2.1 MANUAL CLEANING

- open the heat exchanger as per the dismantling instructions (page 5);
- if a brush is needed to remove solid residues from the plates, use one with soft or plastic bristles. Wire brushes on stainless steel may accelerate the formation of oxide and/or corrosion of the plates;
- rinse each individual plate with fresh water. A high pressure water jet may be used but take care, with glued gaskets, to aim the jet perpendicular to their surface to avoid detaching them;
- take care not to scratch the surface of the gaskets since this would reduce their supporting surface;
- follow the instructions given under "Advice" to identify the best detergent for the type of deposit on the plate;
- TAKE SPECIAL CARE IN CLEANING AND DRYING THE GASKETS. Any particles of dirt adhering to the surface of the gasket could cause fluid loss from the heat exchanger. We also advise cleaning the back of each plate since it is in contact with the circulating fluid too;
- dirt usually collects on the lower part of the plate, so pay special attention to this area during cleaning.

ADVICE

- for cleaning stainless steel plates do not use hydrochloric acid, muriatic acid, or water that contains more than 300 ppm of chlorides;
- do not use phosphoric acid for cleaning titanium plates.

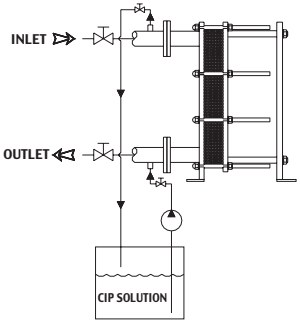
Types of deposit:	**Detergents Suggested for the cleaning of AISI 304/316 stainless steel components**
Scaling	Nitric acid at 4% max. 60 °C – Citric acid at 4% max. 60 °C
Oil and grease	Paraffin or Kerosene (gaskets in nitryl and EPDM may be damaged by these liquids – limit contact to 30 minutes maximum)
Sludge, metal oxides	Nitric acid at 8% max. 60 °C – Citric acid at 4% max. 60 °C
Organic deposits	2% solution of caustic soda at max. 40 °C

Important

- always wear protective goggles and gloves during cleaning. Follow the instructions given in the safety sheet for the product in question.
- wastewater must be disposed of in accordance with the environmental regulations in force.

2.2 CHECK WITH PENETRATING FLUIDS

Once deposits and scaling have been removed from the plate you are advised to check its intactness.
The action of corrosive liquids, possible galvanic currents, mechanical friction etc. could reduce the thickness of the plate to the point of causing perforation.
With the aid of penetrating fluids you can detect any micro-fractures of the sheet metal that are not visible to the naked eye but are shown up by the contrast between the penetrating fluid and the colouring applied to the other side of the plate.
This operation is recommended with view to avoiding any serious problem of fluid mixing between one circuit and the other.
Contact our technical department for information about the recommended products.



2.3 CIP (CLEANING IN PLACE)

This type of cleaning is employed when there are corrosive liquids in the circuits and careful washing is required without opening the heat exchanger.

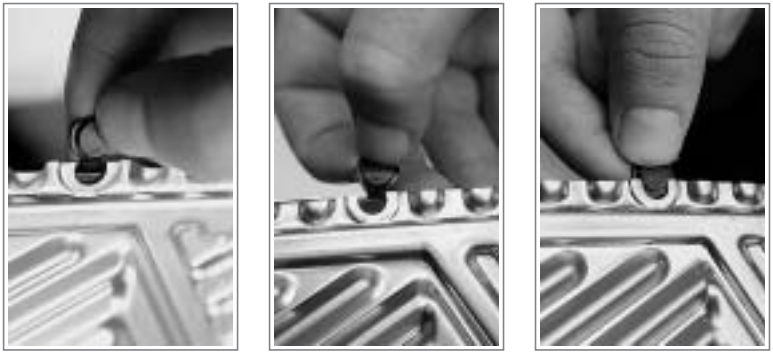
Prepare the heat exchanger as follows:

- empty both circuits with the drain valves; if this is not possible, put fresh water into circulation until the process fluids are completely emptied out of the system and collected in accordance with the disposal regulations;
- in any case provide for washing with fresh water at about 40°C (with low chloride content in the case of steel plates) to eliminate all traces of process fluids;
- completely empty the circuits of water and hook up the CIP unit (see “Advice” for the recommended detergents);
- for the best cleaning result place a centrifuge pump between the CIP unit and the heat exchanger so that the detergent liquid circulates from the bottom up in such a way as to eliminate all residues of dirt;
- circulate fresh water in the direction opposite to the usual one (invert inlet/outlet); remember that filters placed upstream of the heat exchanger reduce the necessity of inverted circulation;
- if possible, provide for cyclical inversion of fluid flow – particularly advised in steam/product applications;
- If the CIP consists of a hydroxide solution and an acid rinse you first do the hydroxide cleaning followed by a water flush and than the acid rinse followed by a water rinse;
- circulate a quantity of detergent solution greater than the usual circuit fluid capacity (adviced capacity 2 to 3 times the usual flow);
- after CIP, rinse both circuits with fresh water.

Note a: To eliminate problems of dirtying by residues (fibres or particles) that block the heat heat exchanger channels, inverted circulation is often the best solution as long as these particles do not damage the surface of the plates; otherwise the best way is manual cleaning.
When on opening the heat exchanger a significant number of gaskets are found to be worn, without flexible return to the rest position, you should consider replacing the whole set. We underline that putting plates with new gaskets and plates with old gaskets in the same group will cause compression overstress on the new gaskets which will therefore have a shorter working life. So to ensure perfect sealing of the heat exchanger it is unadvisable to close a plate pack with new and old gaskets together.

2.4 PLUG-IN GASKET REPLACEMENT

Remove the worn gaskets from their housing on the perimeter of the plate. If they adhere to the plate surface, do not use a sharp tool to free them.
After cleaning the gasket channel of any oil residues or dirt particles with a suitable detergent, position the new gasket on the plate, taking care that the "fluid leak detection" notches are facing upwards.
Check that the grommets on the gasket and the recesses on the plate perimeter are aligned in such a way as to allow correct insertion.
Take care to fix the gasket grommets firmly in the channel on the plates.
Turn the plate for a rapid and immediate check on correct positioning of the Plug-ins.
You are advised to follow this operation with an inspection test of the heat exchanger to ensure that there are no leaks between the circuits and no external leaks (correct gasket positioning).
.



An exclusive Cipriani Scambiatori Srl patent covers plug-in gaskets

2.5 GLUED GASKET REPLACEMENT (mod. S100/S250)

After removing the plates from the heat exchanger, lay them on a horizontal surface and remove the gaskets from their channel. To avoid damaging the plates, do not use sharp tools. If necessary immerse the plates in a tank of liquid nitrogen and the gaskets should be easily detachable.

Clean the gasket channel with a solvent such as methyl ethyl ketone (MEK) or another acetone based solvent to weaken the old glue and to degrease the channel.

Dry the gasket channel well and apply a uniform 1 mm thick layer of glue. Warning: the quantity of glue must not be so excessive as to seep just outside the gasket channel once the gasket has been applied.
Wait about 30 seconds before positioning the gasket.
Approximate quantity of glue per plate:

100	250
gr. 4,5	gr. 7

Position the gasket with the “fluid leak detection” notches facing upwards. Manually fix the gasket in its original place on the plate.

Keep the plate compressed under a uniformly distributed weight for at least 12 hours at a surrounding temperature of about 20 °C (if there are several plates they can be piled).
Then reinsert the plate with the new gasket into the frame.

All the operations described must be carried out wearing suitable protective goggles and gloves in observance of the specific accident prevention regulations.

2.6 WARNINGS CONCERNING CORRECT MAINTENANCE:

- on receipt of the ordered product and in any case before carrying out any maintenance carefully read all the documentation that comes with the heat exchanger. In this way you can check correspondence to the design agreed in the purchase order phase and the compatibility of materials under effective working conditions. The Risk Analysis (page 14) should also be studied carefully in order to ensure long-lasting functioning without violating heat exchanger minimum safety requirements.
- the maximum and minimum temperatures given on the label are set in function of the range of use of the materials with reference to heat exchanger components.
- the guiding bars must be periodically lubricated to ensure duration of their designated function.
- similarly the tightening bars and nuts must not be subjected to chemical aggression that would jeopardise their function during maintenance. Lubricate them periodically and protect them against any aggressive agents.
- spare gaskets should be stored in a dry place away from light, dust and sources of heat, but in any case for a period not longer than:

  gaskets

  NBR 12 months

  EPDM 12 months

  FPM 6 months

  Starting from the invoice date.
- compressed gaskets (heat exchanger ready to run) should be stored for a period not longer than a month, keeping the heat exchanger packed in the same conditions as in the previous point.
- it is forbidden to remove the heat exchanger guarantee seal that consists of a strap around the plate pack.

3. Risk analysis

To avoid all risks not envisaged in this manual you must observe the functioning conditions that refer to the specifications agreed on at design stage. This information is given in detail in the thermal programme.

Warning: the data on the label refers to the maximum and minimum temperatures tolerated by those materials with the most restricted working range. For the temperatures permitted inside the heat exchanger you must refer to the Thermal Programme, specifically calculated for each individual product.

ALL MAINTENANCE WORK ON THE HEAT EXCHANGER MUST BE CARRIED OUT:

- IN SAFE CONDITIONS (observing the accident prevention regulations)
- AFTER STOPPING THE HEAT EXCHANGER AND IN ANY CASE WITHOUT ANY LIQUID PRESSURE REMAINING IN IT
- ONLY AFTER HAVING CONTACTED THE MANUFACTURER.

1. PHASE: INSTALLATION

CAUSE **Transport unsuitable.**
EFFECT Deformation of external frame, deformation of the outlets.
DANGER Structural failure, no holding of nominal pressure, fluid leak.
SOLUTION
(a) The heat exchanger must be suitably packed by fixing it to special pallets and covering it with 0.15 mm thick shrink-film
(b) Avoid stresses of any kind that might modify the structure of the heat exchanger.
(c) Lifting must be carried out with appropriate means, raising the heat exchanger from the base of the pallet when it is still packed, or by the tightening bars with the aid of ropes.
(d) Never lift the heat exchanger by its connections.

CAUSE **Incorrect positioning of the heat exchanger.**
EFFECT Insufficient space for maintenance (opening/closure of plate pack and collection of fluids in the plant draining phase); inappropriate installation in the vicinity of electrical switchboards, sources of dispersed electric currents, devices causing thermal or mechanical stresses, corrosive chemical substances or solvents in contact with the external surface of the heat exchanger.
DANGER Incorrect maintenance, leaking of hot fluid onto the electrical circuit, deformation of the external frame, failure to maintain nominal pressure, flooding.
SOLUTION
(a) Position a suitable container under the heat exchanger. It should be of a volumetric capacity appropriately greater than the design stage value of the heat exchanger and in order to take account of the volume of fluid in the pipes between the shutoff valves.
(b) Install adequate earthing systems on the plant.
(c) It is forbidden to place external loads on the equipment; the installer must protect the heat exchanger from external stresses.

CAUSE	**Imprecise tightening of the plate pack.**
EFFECT	Loss of nominal pressure, plant malfunctioning
DANGER	Fluid leak.
SOLUTION	(a) Check that the tightening parameter and the number of plates correspond to the values shown on the heat exchanger label. (b) When tightening, check parallelism of the two frame plates. (c) Check that the guarantee seal around the plate pack is intact.

CAUSE	**Incorrect fixing to the connections**
EFFECT	Fluid leaks, flooding, inappropriate installation.
DANGER	Leak of dangerous fluid, plant malfunctioning, incorrect maintenance.
SOLUTION	(a) Follow the instructions on the label and in the user manual. (b) You are advised to use Teflon tape on the connector threads. (c) Check that there is no force, movement or vibration affecting the connections. (d) Check that the hooked up tube system is protected against sudden overpressures, and avoid temperature variations in the case of plastic tubing. (e) Supply and draining tubes must be adapted to the stop valves in such a way that the heat exchanger may be stopped and opened without interfering with the rest of the plant. For both circuits there must be a vent valve (installed at the highest point) between the heat exchanger and the fluid inlet shutoff valve so that opening of the heat exchanger may be carried out at atmospheric pressure. (f) Tighten the flanges to the front plate leaving an opening of 2 mm in case the seal is warranted by a rubber liner.

CAUSE	**Incorrect heat exchanger filling.**
EFFECT	Fluid leaking from the heat exchanger.
DANGER	Water hammering; sealing gaskets shifted from their housings.
SOLUTION	(a) Fill the heat exchanger gradually, little by little opening the fluid inlet shutoff valves.

CAUSE	**Unsuitable long-term storage conditions**.
EFFECT	Premature ageing of elastomer gaskets, corrosion of the tightening bars, solid residues (dust) in the plant under working conditions.
SOLUTION	(a) Store the heat exchangers in a closed, humid (max. 75%) environment at 15°C - 20°C, away from sources of heat and light and protected from dust, solvent or acid of any kind. (b) Observe the storage duration limits (shown on the material certificates and indicated by the manufacturer) with reference to the type of gasket employed. (c) Having requested permission from the manufacturer, loosen the tightening bars and treat them with an antirust product. (d) Cover the heat exchanger with an opaque tarpaulin.

2. PHASE: RUNNING

CAUSE **Gaskets out of their housing: gaskets deteriorated.**
EFFECT Fluid leaking from the heat exchanger.
DANGER External leak of fluid from the plate pack while running; danger in the case of chemical reaction between fluids, which could have explosive, toxic or harmful effects.
SOLUTION
(a) Replace deteriorated gaskets.
(b) Place a recipient under the heat exchanger to collect the leaking fluid. In the case of spilt oil, put down sawdust or cardboard to contain spreading.
(c) Assemble the plate pack correctly during maintenance, following the technical assembly diagrams on page 7 or 8 depending on type of circulation.
(d) Provide for automatic pressure adjustment and control systems in order to avoid water hammering and consequent shifting of the gaskets.
(e) Avoid mechanical stress, thermal stress (exceeding maximum working temperatures) and sudden variations in temperature.
(f) Avoid material ageing by carrying out proper maintenance.
(g) The gaskets are designed with an area , in correspondence to the holes, that permits circuit fluid to discharge externally (limiting, in such an event, mixing of the fluids).

CAUSE **Eddy currents in the heat exchanger.**
EFFECT Perforation of the plates due to corrosion or electroerosion.
DANGER Mixing of the fluids in the two circuits; plant malfunctioning.
SOLUTION
(a) In all cases avoid eddy currents
(b) Provide suitable earthing systems on devices that could generate such currents.
(c) Check whether the fluids have corrosive properties.

CAUSE **Slackening of the tightening bars due to mechanical stress.**
EFFECT Decompression of the gaskets.
DANGER Fluid leak from the plate pack during functioning.
SOLUTION
(a) Avoid stresses due to vibrations transmitted to the heat exchanger by the plant tubing, machinery or other devices.
(b) You are advised to check the tightening measure of the plate pack monthly.

CAUSE **External leaking from the connections.**
EFFECT Plant malfunctioning and pressure loss.
DANGER Escape of fluid (perhaps dangerous), which is not easily recoverable in the collection container beneath the heat exchanger.
SOLUTION (a) Avoid impact on the outlets and vibrations transmitted to the outlets.
(b) Hook up the heat exchanger to the plant correctly, following the instructions on page 3 .
(c) Avoid water hammering and thermal stress.
(d) The plant must be equipped with a safety valve.

CAUSE **The fluids contained are at high temperatures**
EFFECT External surface of the heat exchanger is very hot.
DANGER Danger of burns on contact with the external frame of the heat exchanger in case of very high working temperatures (up to 200° C) of the fluids in the circuits.
SOLUTION (a) Provide suitable heat insulation systems, and in all cases pay attention to contact if high temperatures are indicated in the design.
(b) Under working conditions take care to keep temperatures constant as per design temperatures.

CAUSE **Incorrect use of the heat exchanger.**
EFFECT Different working conditions with respect to the design parameters.
DANGER Unsafe working conditions; inefficiency not guaranteed by the manufacturer.
SOLUTION Carefully read the thermal programme agreed upon at the design stage.

3. PHASE: MAINTENANCE AND DISMANTLING

CAUSE **Incorrect emptying of the heat exchanger**
EFFECT Uncompleted depressurisation and emptying of the Heat exchanger
DANGER Formation of toxic vapours, possibility of contact with dangerous fluids.
SOLUTION (a) Maintenance must be carried out with the plant switched off.
(b) For fluid depressurisation there must be, on both circuits, an air valve between the heat exchanger and the shutoff valve.
(c) The operator must be equipped with gloves, overalls and an air purification system.
(d) Place a suitable container beneath the heat exchanger. The container must be of a volumetric capacity appropriately greater than the design value in order to include the volume of fluid in the tubing between the shutoff valves and the heat exchanger itself.

CAUSE	**Inadequate manual cleaning.**
EFFECT	Worn plates have fluid residues on their surface.
DANGER	The fluid residues may be toxic and corrosive. The plates are sharp at the edge.
SOLUTION	(a) The operator must wear suitable gloves and overalls. (b) Carry out thorough cleaning of the plates to remove all residues, using a soft bristle brush and either hot water or a solution, depending on the type of fluid in the circuit.

CAUSE	**Incorrect assembly of the plate pack.**
EFFECT	Mixing of the fluids in the two circuits; misalignment of the plates.
DANGER	Danger in cases of chemical reaction between the fluids, which could cause explosion or toxicity or be harmful to personnel. External fluid leaks.
SOLUTION	(a) Check for correct positioning and orientation of all the plates. (b) Do not tighten the nuts on the tightening bars with a compressed air tool. (c) Pay attention to all the instructions in this user and maintenance manual, which comes with the heat exchanger.

CAUSE	**Tightening bars not lubricated**
EFFECT	Impossible to loosen the brace nut.
DANGER	The maintenance technician has to cut the tightening bar in order to open the plate pack.
SOLUTION	a) Provide for correct lubrication of the tightening bars and protection from external agents.

4. Troubleshooting

FLUID LEAK BETWEEN THE PLATE PACK AND THE FRAME

Problem	Solution
1. If the leak is at the connection, check the state of the initial gasket: the problem may be caused by cuts or by shifting of the gasket.	• Reposition the initial gasket correctly. • Replace the initial gasket. • Tighten each loosened bolt and check that there is no mechanical stress on the tubes.
2. Check that the internal surface of the front frame plate has no surface defects and that there are no foreign bodies between it and the initial plate, which might have jeopardised the seal of the gasket.	• Eliminate all interference (residues, defects) between the initial gasket and the surface of the front frame plate.
3. Check that the initial plate has no notches or holes	• If the plate is not intact it must be replaced.

EXTERNAL FLUID LEAK FROM THE PLATE PACK

Circle the leakage point with a marker and open the heat exchanger, following the instructions for dismantling.

Problem	Solution
1. Temperature and pressure in the heat exchanger are not in accordance with design specifications.	• Reset working conditions as per design specifications. The plant must have suitable indicator instruments.
2. Check that the tightening measure, which conditions compression of the plate pack, corresponds with the value shown on the label.	• Remove pressure and tighten the plate pack to the correct value as shown on the label.
3. Check that the gaskets are correctly positioned in their housing.	• Return shifted gaskets to their housing.
4. Check that they are not damaged or too worn (on opening the plate pack the gasket does not have flexible return to its original conformation).	• Replace damaged gaskets.
5. Check that the plates are correctly mounted (page 7-8) and that they are aligned.	• Reassemble the plates in the correct sequence (see assembly diagrams) and align them.

INTERNAL LEAKS BETWEEN THE HEAT EXCHANGER CIRCUITS, AND CONSEQUENT MIXING OF THE FLUIDS (VERY RARE)

Contact the manufacturer immediately.

Problem	Solution
1. Check that the tubes are connected to the heat exchanger as per the circulation diagram indicated on the heat exchanger label.	• Connect the tubes correctly.
2. Check each plate with penetrating fluid (page 4.4) to detect any holes or notches not visible to the naked eye.	• Replace perforated plates.
3. Check that the plates are mounted in the correct sequence (page 4.3)	• Reassemble the plates in the correct sequence.

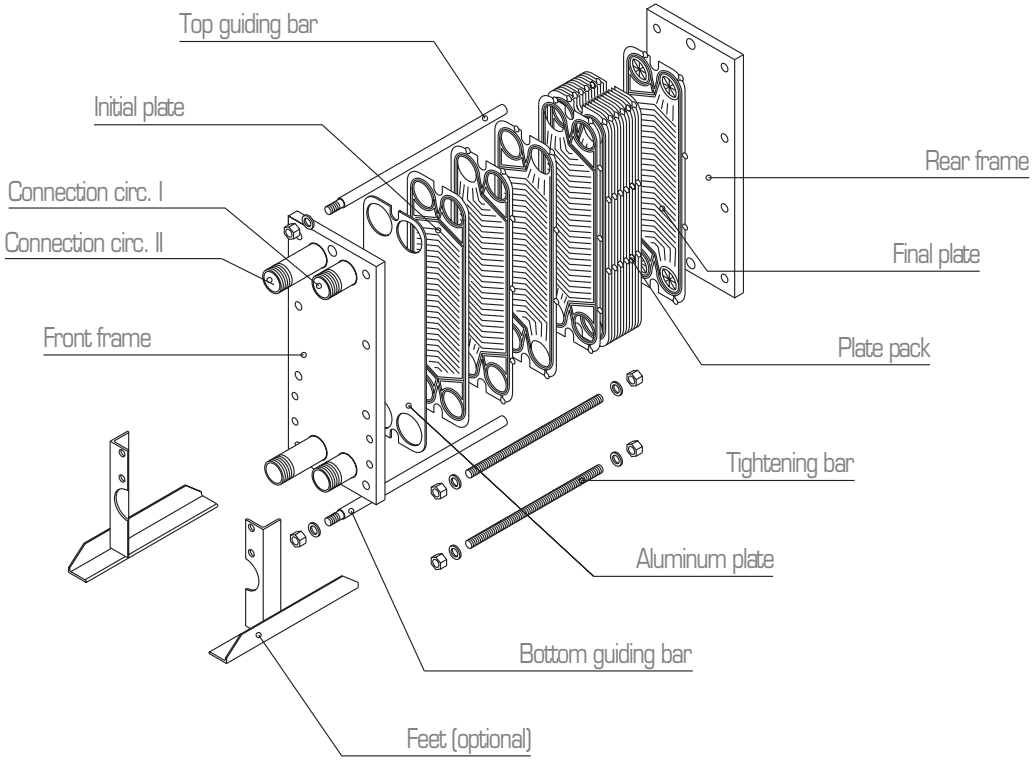
INCREASE IN PRESSURE DROP OR TEMPERATURE VARIATION

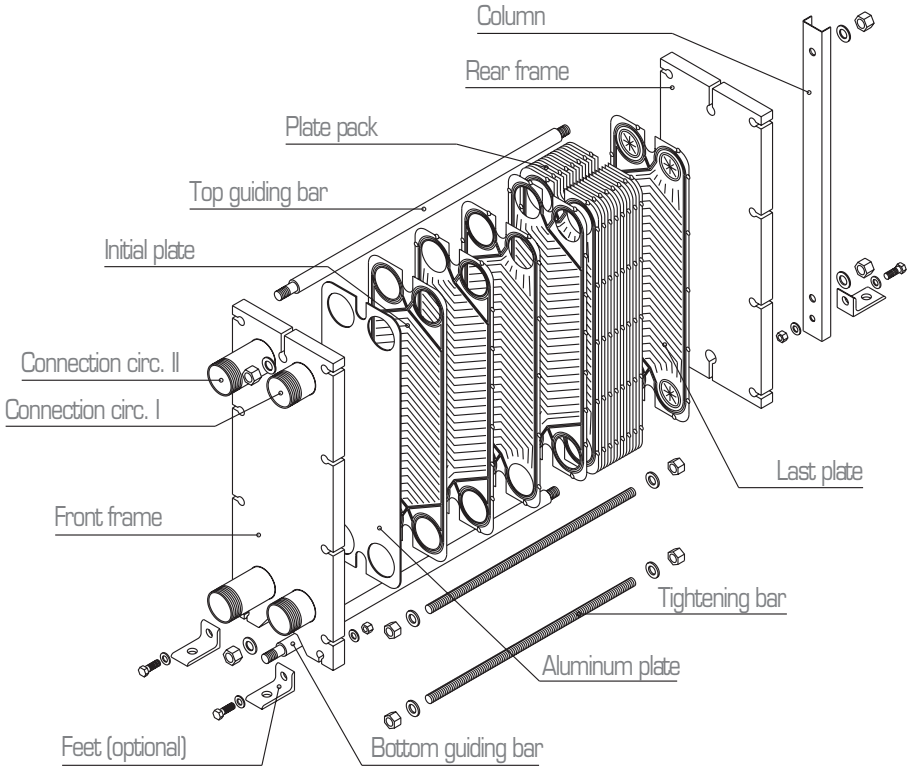
Problem	Solution
1. The pressure drop has exceeded the one scheduled in the design.	• Check accuracy of measuring instruments. Clean the heat exchanger (page 9)
2. The temperatures are correct but pressure drop is still too high.	• If the plates are clean, something may be blocking the connections or the channel entrances. You are advised to try circulating the fluid in the opposite direction (page 10)
3. The temperatures no longer correspond to the original ones.	• Dirt may have reduced channel depth and consequently exchange capacity (yield drop). Contact the manufacturer for cleaning of the heat exchanger.
4. The heat exchanger is clean but pressure drop is too low.	• Check pump functioning.

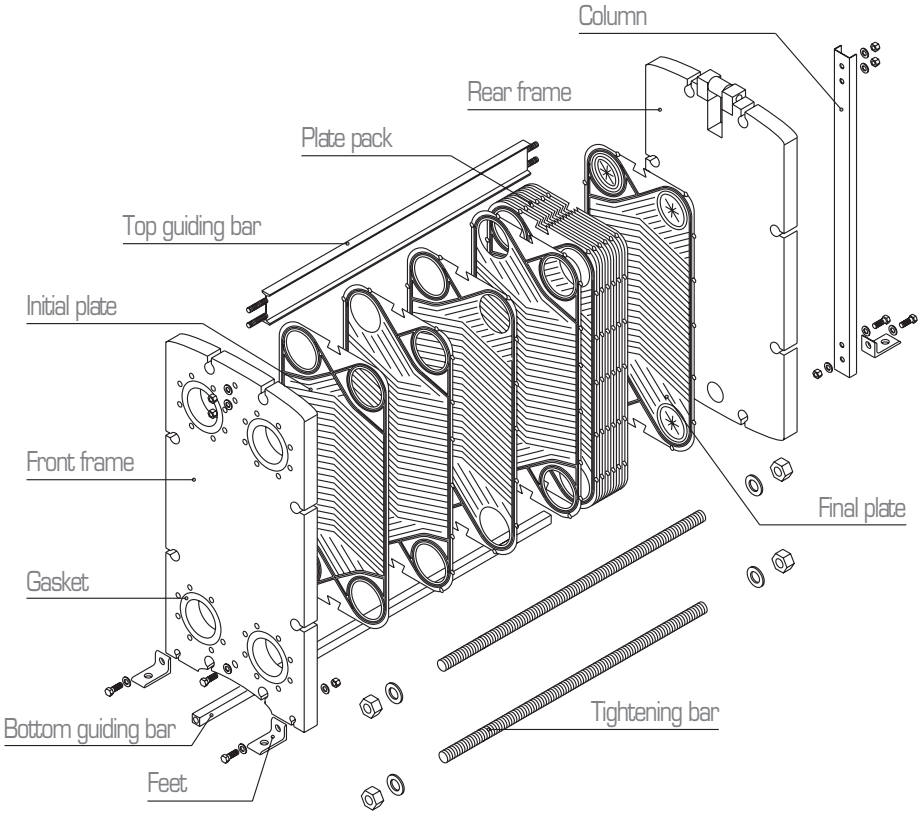
FLUID LEAKS BETWEEN CONNECTION AND FRAME

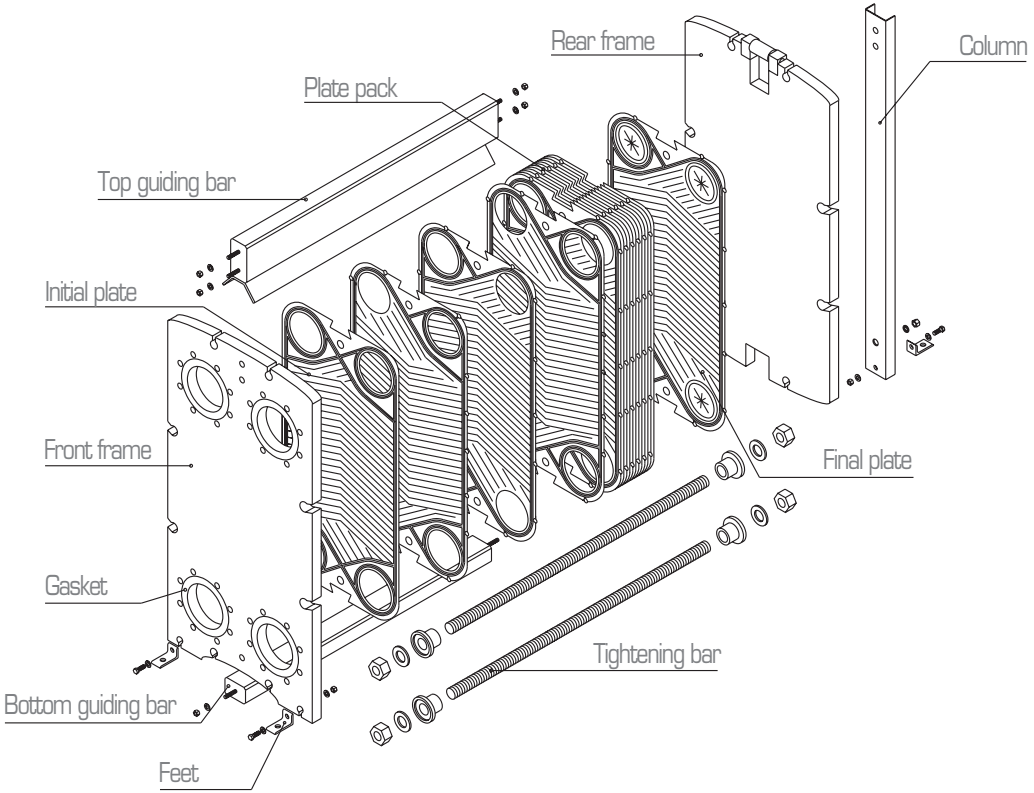
Problem	Solution
1. The fluid leaks in the area between the connection and the front frame plate.	• In the case of welded connections; check that the weld is intact. If it is cracked, always contact the manufacturer before re-welding. • If the outlet is mobile, carry out the same checks and, after contacting the Manufacturer, replace the outlet. • If the flanges have a rubber liner, check that an opening has been left between the flat flange and the front plate of 2 mm.

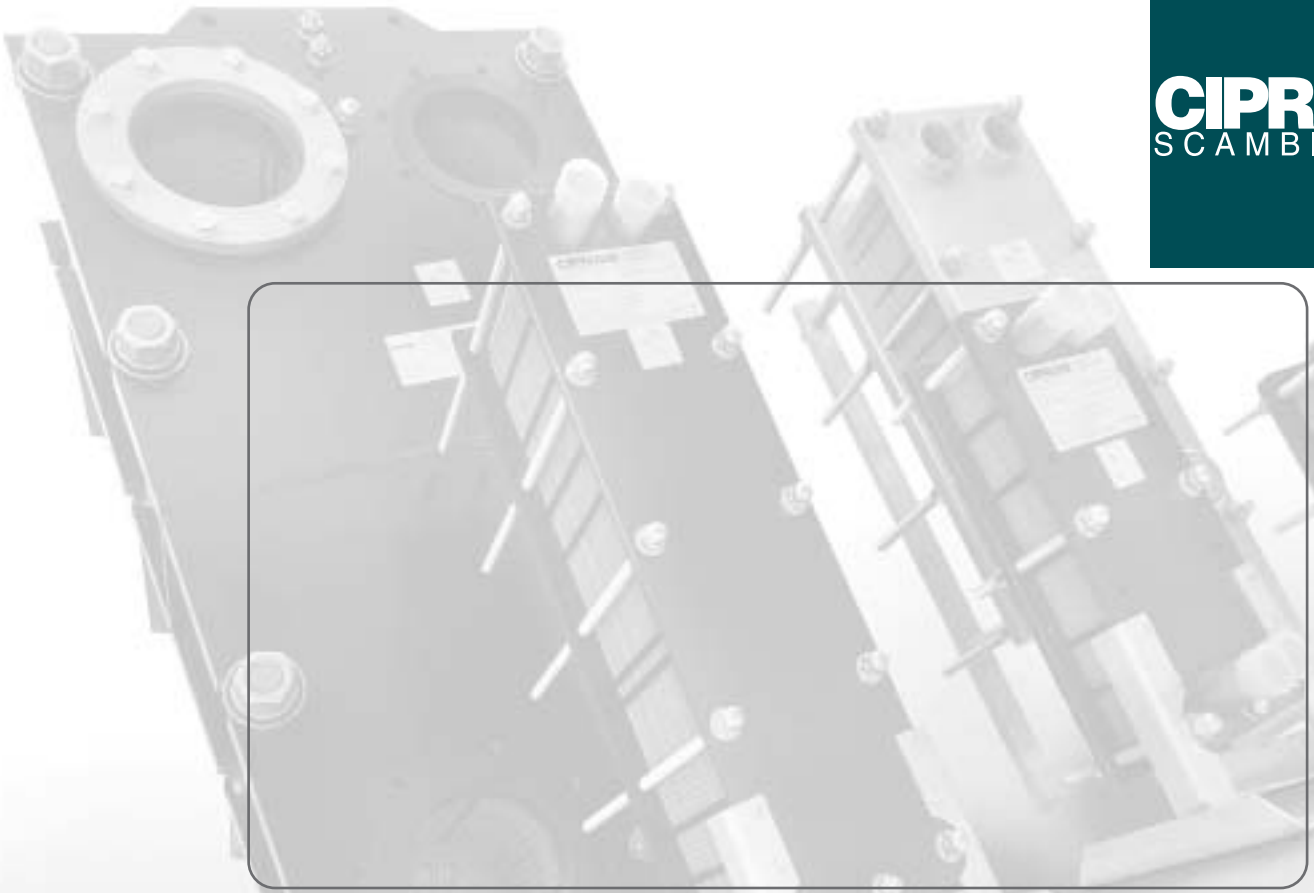
5. Component blow - up drawings




Column
Rear frame
Plate pack
Top guiding bar
Initial plate
Connection circ. II
Connection circ. I
Front frame
Last plate
Tightening bar
Aluminum plate
Feet (optional)
Bottom guiding bar


Column
Rear frame
Plate pack
Top guiding bar
Initial plate
Front frame
Final plate
Gasket
Tightening bar
Bottom guiding bar
Feet


Rear frame
Column
Plate pack
Top guiding bar
Initial plate
Front frame
Final plate
Gasket
Tightening bar
Bottom guiding bar
Feet



CIPRIANI
SCAMBIATORI

2003/01

Via XXV Aprile, 35 • 37020 Corrubio di Negarine - VERONA (Italy)
Tel. ++39.045.6859012 • Fax ++39.045.6859040 • www.cipriani.it